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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of	
Frank Holm Iversen et al.	Examiner: Chong H. Kim
on PISTON COMPRESSOR, PARTICULARLY HERMETICALLY ENCLOSED REFRIGERANT COMPRESSOR	Group Art Unit: 3682
Serial No.: 09/977,409	
Filed On: October 15, 2001	(Docket No. 6495-0007)

Hartford, Connecticut, April 28, 2004

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APPEAL BRIEF

S I R:

This appeal is taken from the Final Office Action, mailed January 30, 2004, in which claims 1-10 of the above-referenced application were finally rejected under 35 U.S.C. § 103(a).

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REAL PARTY IN INTEREST

The real party in interest in the above-referenced patent application is:

DANFOSS Compressors GmbH
D-24904 Flensburg
Germany

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences of which Applicants are aware regarding the above-referenced application.

STATUS OF CLAIMS

Claims 1-10 are pending in this application. (A copy of the claims as entered is attached as an Appendix.) Claims 1-10 stand finally rejected under 35 U.S.C. § 103(a). All rejected claims are presented to the Board in this Appeal.

STATUS OF AMENDMENTS

An Amendment and Response, dated November 19, 2003, responding to the Office Action of August 20, 2003, was entered.

SUMMARY OF INVENTION

The invention relates to a compressor, with a crank drive 1 having a crank shaft 2 with an eccentric crank pin 3 and an oil channel arrangement 17 (page 8, line 32 – page 9, line 3 and page 10, lines 14-15). A connecting rod 4, with a crank pin rod eye 20 and piston-side rod eye 21, has a longitudinal channel 23 for carrying oil connecting the rod eyes (page 9, lines 9-17 and page 10, line 32 – page 11, line 2). Lubricating conditions are improved in the present invention by inserting a bearing element 5 between the crank pin 3 and the crank-pin rod eye 20 (page 9, lines 13-17). This bearing element is unrotatably connected with the crank-pin rod eye (Id). A circumferential oil channel 27 is formed between the outer wall of the bearing element 5 and the inner wall of the crank pin rod eye 20 (page 11, lines 13-21). The oil channel arrangement of the crank pin 3 communicates with the longitudinal channel 23 of the connecting rod 4 via the circumferential oil channel 27 and a control arrangement (page 11, line 23-page 12, line 28).

According to a first aspect of the present invention, a hermetically enclosed refrigerant compressor is provided (Field of the Invention, page 1, lines 5-12 and

claim 1). As shown in Figs. 1 and 3, a compressor block 12 having a bore extending therethrough is provided. A crank shaft 2 is positioned for rotation in the bore. The crank shaft 2 defines an eccentric crank pin 3 at one end. The crank shaft 2 and the crank pin 3 cooperating to define an oil channel arrangement 17. A connecting rod 4 is attached at one end to a bearing element 5 such that there is no relative motion between the bearing element 5 and the connecting rod 4. As best shown in Fig. 3, the connecting rod 4 has a passage 23 extending therethrough, which is in communication with a channel 27 formed by the cooperation of the connecting rod 4 and the bearing element 5. The channel 27 extends completely around a circumference of the bearing element 5. The crank pin 3 extends into the bearing element 5 and is positioned for rotation relative thereto. A control arrangement 28, 29 provides communication between the channel 27 and the oil channel arrangement 17, at least once per revolution of the crank pin 3.

The arrangement of this piston compressor allows the supply of oil from the crank pin bearing area to the piston area, via the longitudinal channel of the connecting rod, to be timed to arrive at the piston area when the piston load is at a minimum (page 3, lines 22-28). This selective timing is accomplished by offsetting the radial bore of the bearing element in the circumferential direction from the opening of the longitudinal channel of the connecting rod (page 5, lines 11-20). Additionally, the communication between the oil channel arrangement of the crank pin and the oil channel of the bearing area can be configured such that any weakening of the lubricating layer between the bearing element and the crank pin occurs in a relatively low load area (page 3, lines 28-32). This improves the lubrication conditions and the bearing load capability between the crank pin and the bearing element (page 3, line 32 – page 4, line 2). This improved lubrication condition allows the use of a low viscosity, highly fluid oil, resulting in less friction overall and a lower resistance to movement between the piston and the cylinder (page 4, lines 2-7). The efficiency of the piston compressor is improved as a result.

ISSUES

The issues to be resolved are:

(1) whether claims 1-3 and 5-10 are unpatentable under 35 U.S.C. § 103(a) over United States Patent No. 4,856,366 to Nikolaus (hereinafter "Nikolaus");

(2) whether claim 4 is unpatentable under 35 U.S.C. § 103(a) over Nikolaus in view of United States Patent No. 6,024,548 to Bushnell (hereinafter "Bushnell"); and

(3) whether the amendment to Fig. 3 adds new subject matter.

GROUPING OF CLAIMS

Each grouping of claims associated with a claim rejection stands or falls together.

ARGUMENTS

Claims:

Claim 1 is the sole independent claim and is directed to a hermetically enclosed refrigerant compressor. A compressor block having a bore extending therethrough is provided. A crank shaft is positioned for rotation in the bore. The crank shaft defines an eccentric crank pin at one end. The crank shaft and the crank pin cooperate to define an oil channel arrangement. A connecting rod is attached at one end to a bearing element such that there is no relative motion between the bearing element and the connecting rod. The connecting rod has a passage extending therethrough, which is in communication with a channel formed by the cooperation of the connecting rod and the bearing element. The channel extends completely around a circumference of the bearing element. The crank pin extends into the bearing element and is positioned for rotation relative thereto. A control arrangement provides communication between the channel and the oil channel arrangement, at least once per revolution of the crank pin.

Claims 2-10 depend, directly and indirectly, from Claim 1 and recite additional limitations thereto.

Claim 4 further incorporates the recitations of claims 2 and 3. Specifically, claim 4 includes the recitations that the crank pin defines an oil pocket in the area proximate the opening forming part of the oil channel arrangement. The control arrangement includes at least one radial bore in the bearing element, with the bore overlapping an oil source upon rotation of the crank pin. The oil source, which is formed by an opening in the crank pin, forms part of the oil channel arrangement. Applicants believe claim 4 to be separately patentable. The recitations of claim 4 provide a novel means of providing sufficient oil at the bearing surfaces between the crank pin and the bearing element.

Claims 1-3 and 5-10 Are Not Obvious in View of Nikolaus:

Claims 1-3 and 5-10 stand rejected under 35 U.S.C. § 103(a) as being obvious in view of Nikolaus. Although, the Examiner has rejected claims 1-3 and 5-11, claim 11 was actually canceled in response to a previous Office Action.

The legal determination under 35 U.S.C. § 103 is whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. Kahn v. General Motors Corp., 45 USPQ2d 1608, 1613 (Fed. Cir. 1998). An obviousness rejection based on a combination of selected elements in the prior art requires that there be some teaching or suggestion whereby it would have been obvious to someone of ordinary skill in the pertinent art to make the particular selection and combination made by Applicants. In re Kotzab, 55 USPQ2d 1313, 1316 (Fed. Cir. June 30, 2000); Winner Int'l Royalty Corp. v. Wang, 53 USPQ2d 1580, 1587 (Fed. Cir. January 27, 2000).

Nikolaus is directed to a compressor having a rotatable crankshaft 14 attached, via a crank pin 12, to a connecting rod 29 (see Fig. 1). The connecting rod drives a reciprocating piston 20. Oil is supplied through the crank pin 12 to a passage 36 within the connecting rod 29 and from there to the piston 20. A circumferential bearing assembly 24, 26 is located between the crank pin 12 and a crank pin rod eye 29, 30 of the connecting rod (see Fig. 4). Both the bearing assembly 24, 26 and the crank pin rod eye 29, 30 are two-part subassemblies. The two-part bearing assembly is non-rotatably attached to the connecting rod via tabs 65, 66, which mate with insets 68, 69 in the inner wall 35, 39 of the two-part crank pin rod eye 29, 30. The two parts of the crank pin rod eye 29, 30 are bolted together. An arcuate channel 41 is formed in the inner wall 35 of the lower half of the crank pin rod eye 29. Channel 41 runs between and connects two radial ports 52 that are provided in the lower half 24 of the two-part bearing assembly. In addition, oil passage 36 in the connecting rod opens into channel 41. In the crank pin 12, oil is supplied from an axially-aligned channel 38 to a diametrically-aligned channel 51, 51a. Radial ports 52 in the two-part bearing assembly 24, 26 allow the oil to flow from channels 51, 51a to arcuate channel 41, and from there to passage 36 in the connecting rod.

Claim 1, recites, *inter alia*, that a channel formed by the cooperation of the connecting rod and the bearing element extends completely around a circumference of the bearing element. Unlike the invention recited in claim 1,

channel 41 of Nikolaus has a limited length and does not extend completely around the circumference of the bearing assembly. Therefore, Applicants respectfully contend that this recitation patentably distinguishes claim 1 from Nikolaus.

In the final Office Action, the Examiner states that it would have been obvious to modify the limited channel of Nikolaus by having the channel extend completely around the circumference. The Examiner has not indicated that any teaching, suggestion or motivation to extend the limited channel of Nikolaus can be found in Nikolaus, but rather, the Examiner states that "[i]n this case, the motivation can be found in the knowledge (or common sense) generally available to one of ordinary skill in the art." Furthermore, in response to our arguments presented in a Response filed on November 19, 2003, the Examiner stated that the obviousness rejection was "simply related to whether a person of ordinary skill in the art would be capable of extending the channel completely around the bearing element as long as the intended result is accomplished."

Applicants respectfully disagree and contend that the Examiner has failed to establish a *prima facie* case of obviousness. Modifying the prior art has never been based on mere "capability." "The fact that the claimed invention is within the capabilities of one or ordinary skill in the art is not sufficient by itself to establish *prima facie* obviousness." [MPEP, § 2143.01, page 2100-126, section heading]. There must exist some teaching, suggestion or motivation, whether in the references or in the knowledge available to persons of ordinary skill in the art, that would cause someone to modify the prior art and thereby remove any such modification from the realm of hindsight. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." In re Mills, 916 f.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Applicants contend that in this case, the Examiner, finding no such suggestion, has resorted to hindsight.

As shown in Figs. 1 and 4, Nikolaus teaches extending channel 41 from port 52 to port 52 and not beyond the ports. Nikolaus further teaches that channel 41 is formed by a groove that is cut into the main portion 29 of the connecting rod eye and the outer wall of the upper half 24 of the bearing element. Thus, Nikolaus teaches that channel 41 does not extend into the cap portion 30 of the connecting rod eye or into the lower half 26 of the bearing element. To extend channel 41 completely around the circumference of the bearing element, the two mating joints of the bearing element halves 24, 26 and the two mating joints of the connecting rod eye halves 29, 30 would have to be crossed. A person of ordinary skill in the art would recognize that extending channel 41 across these mating joints would greatly increase the potential for leaks and loss of pressure in channel 41. Leakage and/or loss of pressure in channel 41 essentially renders the oil supply arrangement of Nikolaus inoperative. "If the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." In re Gordon, 221 USPQ 1125 (Fed. Cir. 1984). Thus, a person of ordinary skill in the art would not be motivated to extend channel 41 past these joints.

Even further, both ports 52 are formed in the upper half 24 of the bearing element. The purpose of channel 41, as the Examiner has recognized, is to connect the ports 52 to the longitudinal channel 36 of the connecting rod. Thus, again, a person of ordinary skill in the art would not be motivated to extend channel 41 past these ports.

Moreover, Nikolaus teaches using tabs 65, 66 to mate with recesses 68, 69 to keep the two-part bearing element from rotating relative to the two-part rod eye. Tabs 65, 66 are formed on the outer walls of the upper and lower halves 24, 26 of the bearing element proximate the mating joints of these bearing element halves. Recesses 68, 69 are formed on the inner wall 35, 39 of the two-part rod eye 29, 30 proximate the mating joints of these rod eye portions. As best shown in Figs. 2 and 7, these tabs and corresponding recesses partially obstruct, or at

least significantly limit, the lateral wall space available for extending channel 41 past the mating joints of the bearing element halves and the rod eye portions. Although, from the disclosure of Nikolaus, it is not clear what is the lateral width of channel 41, a person of ordinary skill in the art would size channel 41 to provide sufficient flow of oil through channel 41 to longitudinal channel 36. Given the relatively small depth shown in Fig. 4 for channel 41, a person of ordinary skill in the art would provide channel 41 with a lateral width significantly larger than the diameter of longitudinal channel 36 and significantly larger than the available lateral wall space between the tabs and recesses. Thus, in all likelihood, it is not possible to extend channel 41 past tabs 65, 66 and recesses 68, 69, and so once again, a person of ordinary skill in the art would not be motivated to extend channel 41 past these joints.

Finally, the Examiner has referred to statements in the specification where Applicants disclose that the oil channel does not have to extend over the whole circumference [page 7, line 29 to page 8, line 2; page 11, lines 28-31]. Applicants contend that claim 1 is clear on its face. Applicants are claiming that the channel extends completely around the circumference of the bearing element. A statement in the specification alleging that this does not have to be the case has no bearing on what is recited in claim 1.

For at least these reasons, Applicants submit that claim 1 is patentably distinguishable over Nikolaus as applied by the Examiner. Since claims 2-10 depend from claim 1, they also are patentably distinguishable over the applied reference.

Claim 4 Is Not Obvious in View of Nikolaus Combined With Bushnell:

The Examiner has rejected claim 4 under 35 U.S.C. § 103(a) as also being unpatentable over Nikolaus and further in view of U.S. Patent No. 6,024,548 to Bushnell. Claim 4 recites that the crank pin defines an oil pocket in the area proximate the opening forming part of the oil channel arrangement. This oil pocket is designed to "ensure a better spread of oil in the contact area between the bearing element and the crank pin, and secondly it ensures an improved pumping effect" [page 5, lines 5-8].

The Examiner correctly indicates that Nikolaus fails to show an oil pocket on the crank pin in an area near the opening. The Examiner further indicates that Bushnell discloses a crank pin which defines an oil pocket 40-11 in an area proximate an opening 40-8 in an oil channel arrangement. The Examiner then states that it would be obvious to modify the opening of the Nikolaus oil channel arrangement with the oil pocket as taught by Bushnell. Applicants disagree.

Nikolaus discloses oil well recesses 54 formed in the inner wall on the bearing assembly (see Figs. 11-13). These oil well recesses supply lubrication oil to the load-bearing zone of the bearing assembly via "viscous drag" [col. 8, lines 7-11]. Thus, Nikolaus teaches a method for supplying sufficient oil in the contact area between the bearing element and the crank pin. A person of ordinary skill in the art would not be motivated to supply an oil pocket on the crank pin to lubricate between the bearing element and the crank pin to the device of Nikolaus, because the oil well recesses already perform this function. Moreover, oil pockets on the crank pin might actually inhibit the viscous drag operation of the oil well recesses of Nikolaus. In addition, oil pockets on the crank pin might also inhibit the hydrodynamic lubrication achieved in Nikolaus by special shaping of the oil well recesses.

Bushnell teaches that oil supplied to passage 40-8 flows to axial groove 40-11 (see Fig. 2), and at least a portion flows into the annular recess 22-2 [col. 2, lines 56-58]. Combining Bushnell's axial groove 40-11 with the device of Nikolaus would provide an alternative flow path for the oil, because axial groove 40-11 acts as a channel not as a pocket. Basically, rather than oil flowing from channels 51, 51a through ports 52 and from there to channel 41 as disclosed in Nikolaus, oil would flow from channels 51, 51a to axial groove 40-11 where at least a portion of the oil would then come squirting out from between the crank pin and the bearing assembly, via the passage of 40-11 that provides oil to annular recess 22-2 in Bushnell. Thus, axial groove 40-11 completely defeats the purpose of the oil channel arrangement of Nikolaus, and a person of ordinary skill in the art would not be motivated to combine the axial groove of Bushnell with the device of Nikolaus.

Finally, because claim 4 depends from independent claim 1, which Applicants contend is in condition for allowance, claim 4 should also be allowable for at least all of the reasons presented above. Additionally, Bushnell fails to supply the deficiencies of Nikolaus noted above. For at least these reasons, Applicants submit that claim 4 is patentably distinguishable over Nikolaus and over Nikolaus in combination with Bushnell as applied by the Examiner.

The Proposed Amendment to Figure 3 is Not New Subject Matter:

The Examiner has again objected to the drawings under 37 CFR 1.83(a), stating that the drawings must show every feature of the invention specified in the claims. The Examiner stated that the bearing element and the rod eye each including alignment marks as recited in claim 10 must be shown or the features canceled from the claims.

In response to this rejection in the Office Action of March 19, 2003, Applicants had filed an amended Figure 3 showing the alignment marks 36, 37. Reference numeral "36" was added to identify the already existing alignment mark on the bearing element. Reference numeral "37" and an alignment mark on the rod eye were added. In the amended Fig. 3, the rod eye alignment mark 37 was aligned with alignment mark 36 and shown as a rectangular indentation. The Examiner declined to approve the amendment to Fig. 3, stating that new material had been added. Specifically, the Examiner objected "that the proposed drawing containing the alignment mark 37 having such concave configuration." The Examiner has maintained this rejection to date.

While it is true that the alignment mark 37 shown in Fig. 3 was not included in the original drawings, Applicants respectfully submit that it does not constitute new matter. This amendment is amply supported by the claims and the specification.

Claim 10, as originally filed, stated that "the bearing element and the rod eye each include alignment marks." Per MPEP Section 608.01(l), in establishing a disclosure, Applicant may rely not only on the description and drawings as filed but also on the original claims if their content justifies it. Where subject matter

not shown in the drawing or described in the description as claimed in the application as filed, and such original claim itself constitutes a clear disclosure of this subject matter, then the claim should be treated on its merits and requirement made to amend the drawing and description to show this subject matter.

Moreover, Applicants have disclosed in the Summary of the Invention that "[p]referably, the bearing element and the second connecting rod eye are provided with mutually adapted markings. This ensures that during mounting, the connecting rod eye and the bearing element are joined with the correct orientation." [page 7, lines4-8] By disclosing "mutually adapted markings," Applicants have disclosed that the alignment mark on the bearing element and the alignment mark on the rod eye complement and correspond to one another. Thus, Applicants have disclosed that a marking may exist on the rod eye that complements and corresponds to the marking on the bearing element. In the amended Fig. 3, the mark on the rod eye has been placed opposite the mark on the bearing element, i.e., the marks are shown to be mutually adapted. Thus, the location of the mark on the rod eye does not introduce new subject matter. Moreover, it is immaterial if the markings (on either the bearing element or the rod eye) are crescent-shaped indentations, rectangular indentations, scribe lines, painted indications, or any other markings. The specification discloses mutually adapted markings on the bearing element and on the rod eye and does not limit the markings to any particular shape, configuration, or type. The mark shown on the bearing element (alignment mark 36) in the unamended Fig. 3 is merely one particular, non-limiting, embodiment of the generically disclosed "markings." The corresponding mark on the rod eye (alignment mark 37, as shown in amended Fig. 3) need not be limited to the same configuration as the mark on the bearing element.

Thus, the patent application as filed and as maintained throughout the prosecution of this case has always disclosed that the rod eye and bearing element include alignment marks that are mutually adapted. The amendment to

Fig. 3 of the drawings to include the disclosed subject matter does not constitute new matter and Applicants respectfully request that the objection be withdrawn.

Conclusion

In view of the foregoing, it is respectfully submitted that the rejections of claims 1-10 are not well-founded. Accordingly, Applicants respectfully request this Board to reverse the Examiner's rejections and to allow the application under appeal to issue as a patent.

A check in the amount of $330.00 is submitted herewith for covering the fee for filing the Appeal Brief. No additional fees or deficiencies in fees are believed to be owed. However, authorization is hereby given to charge our Deposit Account No. 13-0235 in the event any such fees are owed.

Applicants' Appeal Brief is being filed in triplicate.

Favorable consideration is respectfully requested.

Respectfully submitted,

By _____
Richard R. Michaud
Registration No: 40,088
Attorney for Applicants

McCormick, Paulding & Huber LLP
CityPlace II, 185 Asylum Street
Hartford, CT 06103
860-549-529

APPENDIX

1. (Previously Amended) A hermetically enclosed refrigerant compressor comprising:

a compressor block having a bore extending therethrough;

a crank shaft positioned for rotation in the bore, the crank shaft defining an eccentric crank pin at one end thereof;

the crank shaft and crank pin cooperating to define an oil channel arrangement;

a connecting rod attached at one end to a bearing element such that there is no relative motion between the bearing element and the connecting rod, the connecting rod having a passage extending therethrough and in communication with a channel formed by the cooperation of the connecting rod and the bearing element the channel extending completely around a circumference of the bearing element;

the crank pin extending into the bearing element and being positioned for rotation relative thereto; and

a control arrangement providing communication between the channel and the oil channel arrangement, at least once per revolution of the crank pin.

2. (Original) A compressor according to claim 1, wherein the control arrangement comprises at least one radial bore in the bearing element, which bore overlaps an oil source upon a rotation of the crank pin.

3. (Original) A compressor according to claim 2, wherein the oil source is formed by an opening in the crank pin and forming part of the oil channel arrangement.

4. (Original) A compressor according to claim 3, wherein the crank pin defines an oil pocket in a area proximate the opening forming part of the oil channel arrangement.

5. (Previously Amended) A compressor according to claim 2, wherein the passage defines an opening into the channel and the radial bore is offset in a circumferential direction relative to the opening.

6. (Previously Amended) A compressor according to claim 1, wherein the connecting rod includes a first connecting rod eye opposite the end attached to the bearing element, the connecting rod eye surrounding a piston bolt having a lubrication channel that overlaps the passage at least once during a revolution of the crank pin, the control arrangement establishing the communication between the passage and the channel.

7. (Original) A compressor according to claim 1, wherein the control arrangement establishes the communication during a suction phase of the compressor.

8. (Currently Amended) A compressor according to claim 1, wherein the control arrangement further establishes the communication when a compression phase of the compressor begins.

9. (Original) A compressor according to claim 8, wherein the bearing element defines two radial bores arranged at a predetermined distance relative to each other and to the opening of the passage.

10. (Original) A compressor according to claim 1, wherein the connecting rod defines a rod eye positioned over the bearing element, the bearing element and the rod eye and bearing element each include alignment marks.

11. (Cancelled)